

AEM: Problem Set 1

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```
# Utility functions -----

`%S%` <- function(x, y) {
  paste0(x, y)
}

`%notin%` <- Negate(`%in%`)

#####

# Install packages if needed
package_list <- c("stargazer", "knitr", "haven", "labelled", "ICC", "scales", "tidyverse")
new_packages <- package_list[package_list %notin% installed.packages()[,"Package"]]
if(length(new_packages)) install.packages(new_packages)

library(stargazer)
library(knitr)
library(haven)
library(labelled)
library(ICC)
library(scales)
library(tidyverse)

# Set directories
repo_ <- "H:/GitHub/aem/"
ps1_ <- "C:/Users/austensen/Box Sync/aem/ps1/"

#####

data <-
  read_stata(ps1_ %S% "Thornton HIV Testing Data.dta") %>%
  remove_val_labels

names(data) <- names(data) %>% tolower
```

Part I: Summary Statistics

```
get_summary <- function(data){
  data %>%
    summarise(
      `Average Age` = mean(age, na.rm=T),
      `Percentage of Males` = mean(male, na.rm=T)*100,
      `Percentage with HIV` = mean(hiv2004, na.rm=T)*100
    ) %>%
```

```
kable(digits = 1)
}
```

1.

```
data %>% get_summary
```

Average Age	Percentage of Males	Percentage with HIV
33.7	46.9	5.9

2.

```
data %>% group_by(any) %>% get_summary
```

any	Average Age	Percentage of Males	Percentage with HIV
0	32.5	48.0	5.8
1	33.8	46.1	5.8
NA	34.0	47.4	11.7

```
data %>% group_by(under) %>% get_summary
```

under	Average Age	Percentage of Males	Percentage with HIV
0	34.1	46.4	4.8
1	33.0	47.6	7.5

There are no major differences in the variables between treatment and control groups based on either cash receipt or distance. However, those that received some cash were on average about a year old and 2% more likely to be male than the control group.

3.

```
grps <- c("any", "under")
vars <- c("age", "male", "hiv2004")

ttest_results <-
  data.frame(
    var = character(),
```

```

    P.value = double(),
    stringsAsFactors=FALSE
  )
}

for(grp in grps) {
  i <- 1
  for(var in vars){
    result <- t.test(data[[var]] ~ data[[grp]], var.equal = TRUE)$p.value

    ttest_results[i,1] <- var
    ttest_results[i,2] <- result
    i <- i+1
  }
  writeLines("#### t-test: group = " %S% grp)
  print(kable(ttest_results, digits = 3))
  writeLines("\n\n\n")
}

```

t-test: group = any

var	P.value
age	0.035
male	0.378
hiv2004	0.993

t-test: group = under

var	P.value
age	0.008
male	0.381
hiv2004	0.006

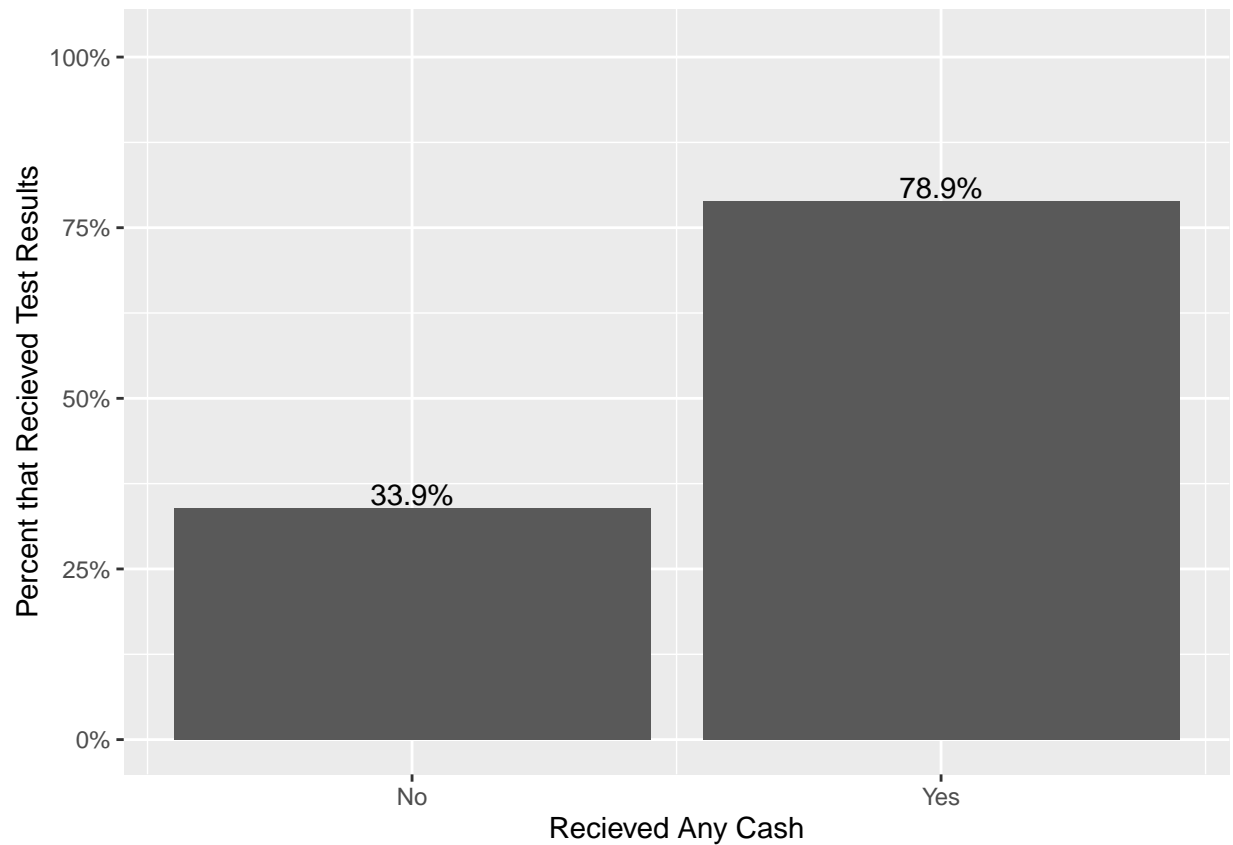
Part II: Analysis using graphs

4.

```

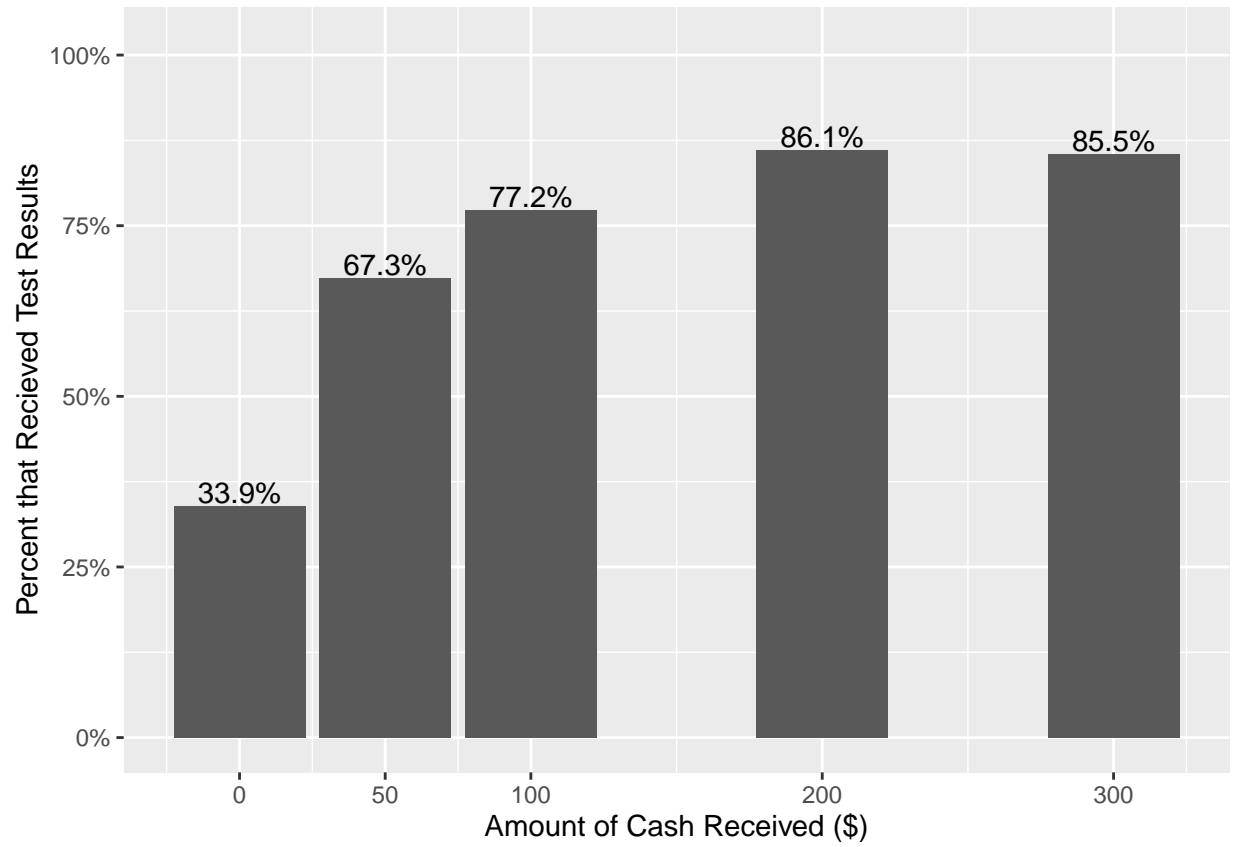
data %>%
  group_by(any) %>%
  summarise(got = mean(got, na.rm=T)) %>%
  ggplot(aes(any, got)) +
  geom_bar(stat = "identity") +
  geom_text(aes(y = got+0.02, label = round(got*100, 1) %S% "%")) +
  xlab("Recieved Any Cash") + ylab("Percent that Recieved Test Results") +
  scale_y_continuous(labels = percent_format()) +
  scale_x_continuous(breaks = c(0,1), labels = c("No", "Yes"))

```



5.

```
data %>%
  group_by(ti) %>%
  summarise(got = mean(got, na.rm=T)) %>%
  ggplot(aes(ti, got)) +
  geom_bar(stat = "identity") +
  geom_text(aes(y = got+0.02, label = round(got*100, 1) %S% "%")) +
  xlab("Amount of Cash Received ($)") + ylab("Percent that Recieved Test Results") +
  scale_y_continuous(labels = percent_format()) +
  scale_x_continuous(breaks = c(0,50, 100, 200, 300))
```



Part III: Analysis using linear regression

6.

```
any_1 <- lm(got ~ any, data = data)
any_2 <- lm(got ~ any + age + male + educ2004 + mar, data = data)

stargazer(any_1, any_2, type = output_type)
```

% Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Sun, Sep 25, 2016 - 1:32:54 PM

Table 6:		
	<i>Dependent variable:</i>	
	got	
	(1)	(2)
any	0.451*** (0.019)	0.450*** (0.020)
age		0.001 (0.001)
male		-0.012 (0.017)
educ2004		-0.008*** (0.003)
mar		0.015 (0.022)
Constant	0.339*** (0.017)	0.354*** (0.039)
Observations	2,834	2,545
R ²	0.163	0.180
Adjusted R ²	0.163	0.178
Residual Std. Error	0.423 (df = 2832)	0.413 (df = 2539)
F Statistic	550.778*** (df = 1; 2832)	111.338*** (df = 5; 2539)
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01		

7.

```
group_diff_any <-  
  data %>%  
  filter(!is.na(any)) %>%  
  group_by(any) %>%  
  summarise(got = mean(got*100, na.rm=T)) %>%  
  spread(any, got) %>%  
  transmute(diff = `1` - `0`) %>%  
  .[[1]]
```

Using a group means comparison, the estimated treatment effect is 45.0551852. This answer does not differ significantly from the OLS coefficient estimate on treatment. Since the addition of control variables does not significantly alter the treatment effect estimate, this suggests that the randomization of treatment was successful in balancing the two groups with respect to these other variables.

8.

```
ti_1 <- lm(got ~ ti, data = data)
ti_2 <- lm(got ~ ti + age + male + educ2004 + mar, data = data)

stargazer(ti_1, ti_2, type = output_type)
```

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Table 7:		
	<i>Dependent variable:</i>	
	got	
	(1)	(2)
ti	0.002*** (0.0001)	0.002*** (0.0001)
age		0.001 (0.001)
male		-0.025 (0.018)
educ2004		-0.013*** (0.003)
mar		0.005 (0.022)
Constant	0.497*** (0.013)	0.544*** (0.037)
Observations	2,834	2,545
R ²	0.125	0.142
Adjusted R ²	0.125	0.141
Residual Std. Error	0.433 (df = 2832)	0.423 (df = 2539)
F Statistic	404.501*** (df = 1; 2832)	84.321*** (df = 5; 2539)
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01		

9.

Part IV: Conditional (Heterogeneous) Treatment Effects

10.

```
any_male <- lm(got ~ any + male + any*male, data = data)
stargazer(any_male, type = output_type)
```

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Table 8:	
	<i>Dependent variable:</i>
	got
any	0.447*** (0.026)
male	-0.017 (0.034)
any:male	0.007 (0.038)
Constant	0.347*** (0.023)
Observations	2,834
R ²	0.163
Adjusted R ²	0.162
Residual Std. Error	0.423 (df = 2830)
F Statistic	183.660*** (df = 3; 2830)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

The estimate for the treatment-male interaction term is -0.0165726. It is not statistically significant. This suggests that there is not differential effect of receiving any cash amount for men and women.

11.

```
any_educ <- lm(got ~ any + educ2004 + any*educ2004, data = data)
stargazer(any_educ, type = output_type)
```

% Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
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Table 9:	
	<i>Dependent variable:</i>
	got
any	0.450*** (0.030)
educ2004	−0.010** (0.005)
any:educ2004	0.0001 (0.005)
Constant	0.387*** (0.027)
Observations	2,550
R ²	0.180
Adjusted R ²	0.179
Residual Std. Error	0.414 (df = 2546)
F Statistic	185.827*** (df = 3; 2546)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Part V: Policy Implications

12.

13.

Part VI: A Random Sub-Sample

14.

```
sample_1000 <- data %>% sample_n(1000)
```

15.

```
any_1 <- lm(got ~ any, data = sample_1000)
any_2 <- lm(got ~ any + age + male + educ2004 + mar, data = sample_1000)

stargazer(any_1, any_2, type = output_type)
```

% Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Sun, Sep 25, 2016 - 1:32:55 PM

Table 10:		
	<i>Dependent variable:</i>	
	got	
	(1)	(2)
any	0.467*** (0.043)	0.487*** (0.045)
age		−0.0001 (0.002)
male		0.043 (0.039)
educ2004		−0.005 (0.006)
mar		0.042 (0.049)
Constant	0.310*** (0.038)	0.278*** (0.091)
Observations	577	514
R ²	0.169	0.200
Adjusted R ²	0.168	0.192
Residual Std. Error	0.428 (df = 575)	0.417 (df = 508)
F Statistic	117.038*** (df = 1; 575)	25.403*** (df = 5; 508)
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01		

Part VII: Choosing Sample Size

16.

17.

```
data %>%  
  filter(!is.na(usecondom04)) %>%  
  ICCbare(site, usecondom04, data = .)
```

```
## [1] 0.01427022
```

Part VIII: Fisher Randomization Test (bonus)

18.

```
# data %>%  
#   filter(!is.na(any)) %>%  
#   group_by(any) %>%  
#   summarise(got = mean(got, na.rm=T))  
#  
# oneway_test(got ~ factor(any), data, alternative = "greater")  
# independence_test(got ~ factor(any), data,  
#                   alternative = "greater",  
#                   distribution = approximate(B = 1000))  
#  
# fisher.test(data$got, factor(data$any), alternative = "greater", simulate.p.value = TRUE)
```
